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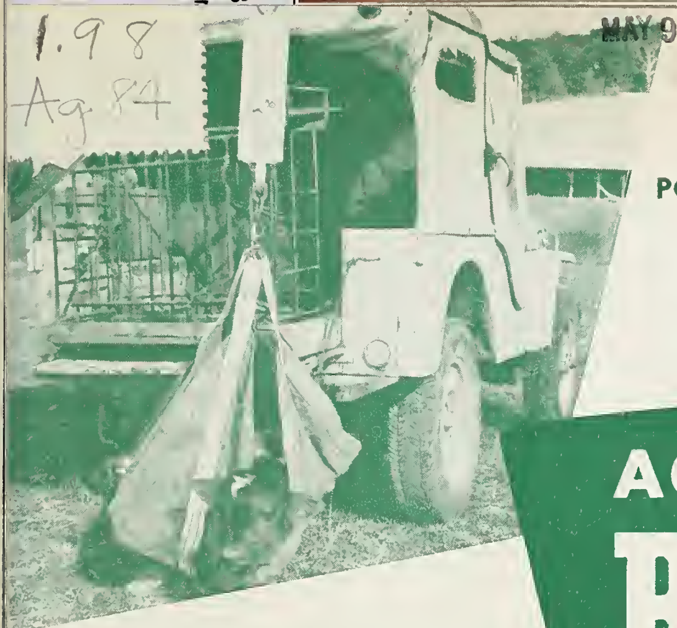
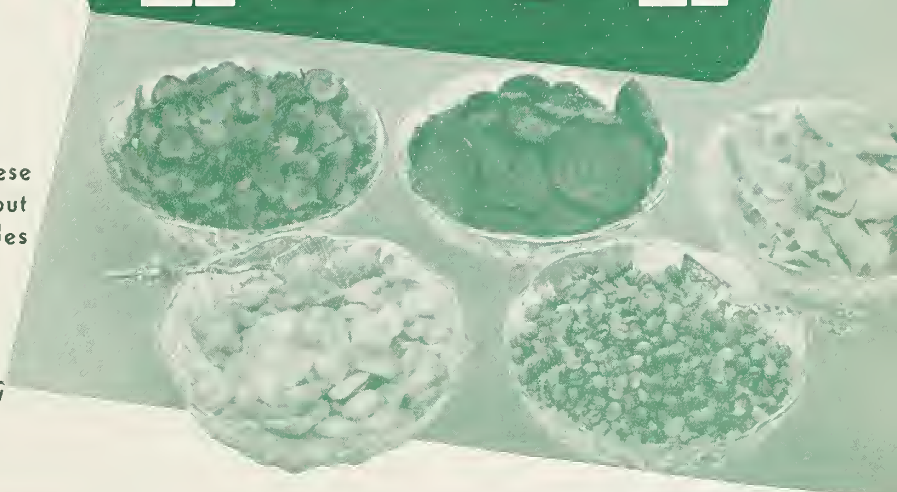


POTENTIAL

Weights, measurements offer potential in our search for a way to pick beef sires early

● see page 3

AGRICULTURAL Research



PRODUCT

You'll probably go for these tasty new snack products out of deep-fat-fried vegetables

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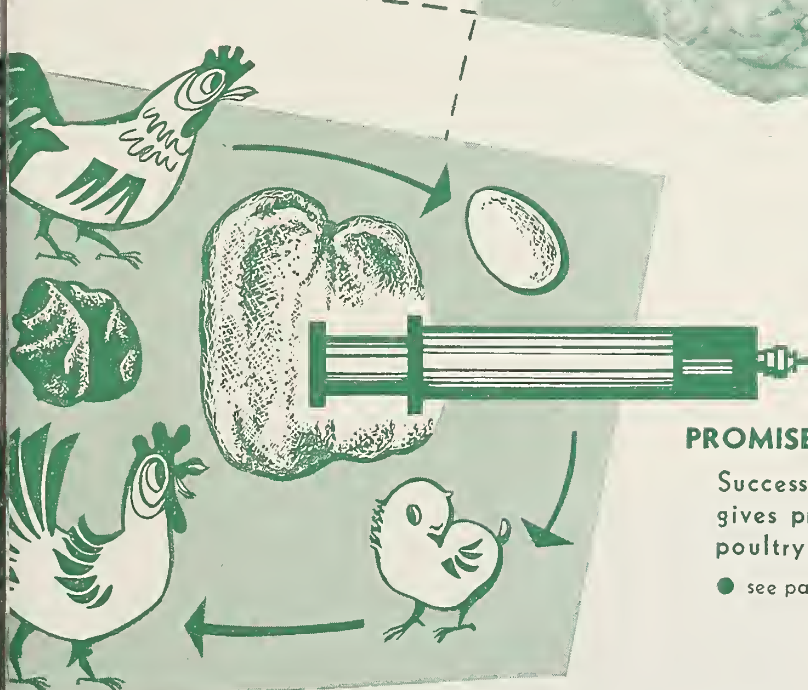

PROMISE

Successful immunization test gives promise for control of poultry's most costly disease

● see page 6

UNITED STATES DEPARTMENT OF AGRICULTURE

AGRICULTURAL
Research

Vol. 3—April 1955—No. 10
Joseph F. Silbaugh—Managing Editor
John R. Deatherage—Assistant Editor

CONTENTS

Achievement

If a scientist were to announce he has immunized several score humans against cancer, that would astonish the world.

A report that will astonish and hearten the poultry world has just come from the Regional Poultry Research Laboratory at East Lansing, Mich. Visceral lymphomatosis—poultry's cancer—has just been blocked in nearly 300 chickens by prior vaccination of the mother hens (p. 6).

Poultrymen will speculate on the hoped-for benefits, but there's a deeper significance for everybody in that report: big vision bears rich fruit, even though the season be long.

This success hasn't come easily. It crowns a 16-year effort by Director Berley Winton and associates—16 seemingly fruitless years of patient search for clues, pursuit down blind alleys, driving toward a single end.

That's the story of a great deal of research. Vision and determination bring these occasional payoffs. Scientists, manning the laboratory and the field plot, have faith. We must keep faith too. It's the end result that we measure.

Management

Water, water—almost everywhere it's short. Limited supplies are holding back expansion of some cities and factories, holding down crop and livestock production on our farms.

Nature ordinarily gives us plenty of water. The trouble is that we haven't learned how to manage it.

Much of our rain falls on agricultural land. But a lot of this water runs off, carrying with it precious soil. We lose great quantities by evaporation from the land surface. Much water escapes by transpiration through plants.

Irrigation has caught on in our humid areas, but lack of water is already limiting its spread. We need to learn more about soils, crops, and water so as to make our water cover more acres and produce greater yields. We should aim to use all water at least once, perhaps many times, before it reaches the oceans or returns to the atmosphere.

Programs for complete water management seem likely. These programs must be based on research in agricultural and watershed hydrology. Much of this work still lies ahead.

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AGRICULTURAL RESEARCH SERVICE
United States Department of Agriculture

FATHER, Ransom Clipper, has a look at his first offspring.

LEARNING HOW TO BREED BETTER BEEF

Cattlemen need improved selection methods

RANSOM CLIPPER of Front Royal 6th is a red and white bull. He's 1 of 40 Shorthorn bulls born in 1953 on the beef-cattle research station operated at Front Royal, Va., by USDA and the Virginia experiment station. He's 1 of 3 bulls kept for breeding.

At birth—March 23, 1953—Ransom Clipper weighed 72 pounds. He was 27.1 inches high, 23.9 inches long, 28.1 inches around the heart girth, 10.4 inches deep in the chest, 19.5 inches in circumference of round, and 8.4 inches long in the hip. His grade was Good.

At 120 days of age he weighed 316 pounds, ranking second among nine half-brothers. Ransom Clipper stood third in score for type, and his grade was Good.

At 182 days he weighed 425 pounds, ranked third in weight, second in type, Low Choice in grade. He then went on a record-of-performance feed test for 168 days.

At 1 year, Ransom Clipper weighed 895 pounds—top for his age in the entire Shorthorn herd. So he was picked to head the growth-rate herd and was bred to cows last spring. His calves were dropped early this year.

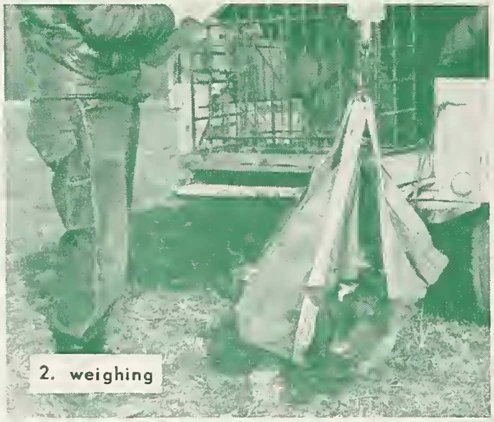
Why the statistics? The researchers are hoping to discover in this data some *guides for selecting herd sires.* They hope to find that some of a bull's physical characteristics at birth or early age correlate well with characters in his offspring, such as weight, grade, rate and efficiency of feed-lot gain, carcass grade and yield, resistance to cancer eye, and type and conformation.

In the late 1930's, USDA and State scientists discovered a high correlation between a calf's feed-lot gain (and that of his brothers and sisters) and the gain that can be expected from his offspring. But you still have to wait until a bull's about a year old to get the record of his performance in the feed lot.

At Front Royal and in 37 other States and the Territory of Hawaii, researchers are trying to establish by the accumulation and analysis of data, a younger age at which

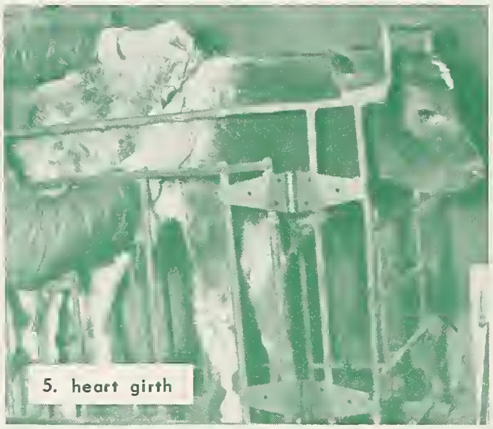
Researchers look for early measures of a good bull


1. new arrival


2. weighing

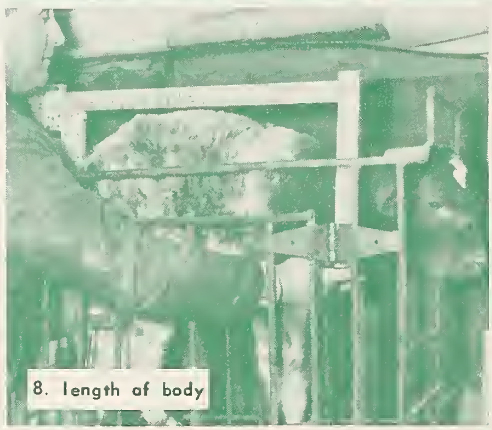

3. tattoo identification


4. eartagging


5. heart girth

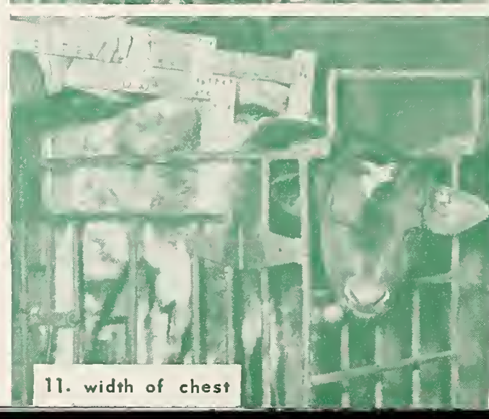

6. circumference of round

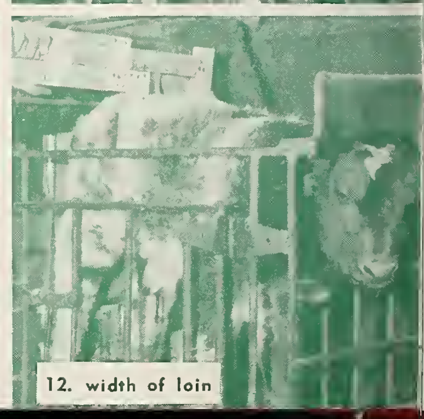

7. height at withers


8. length of body


9. depth of chest


10. length of hip


11. width of chest


12. width of loin

GAINING ABILITY is checked by 168-day feed test in the box stall. Feed bin is kept full. Calf is let out into lot three times daily for exercise and water. He's weighed at the start and finish of test, his gain compared with gain his mother made. Difference is due to father's influence.

a potential sire can be recognized for his true worth. "It would be wonderful," these scientists say, "if a man could make the determination the day the calf is dropped. We aren't anywhere near that point, but we believe that if we can push the date back any measurable distance, cattlemen will benefit."

To further this study, three selection herds are maintained at Front Royal for a given inbred line—a growth-rate herd, a type herd, and an inbred herd. They're duplicated for each of three major beef breeds, Shorthorn, Angus, and Hereford. Actually, there are three sets of such herds for the Shorthorn breed.

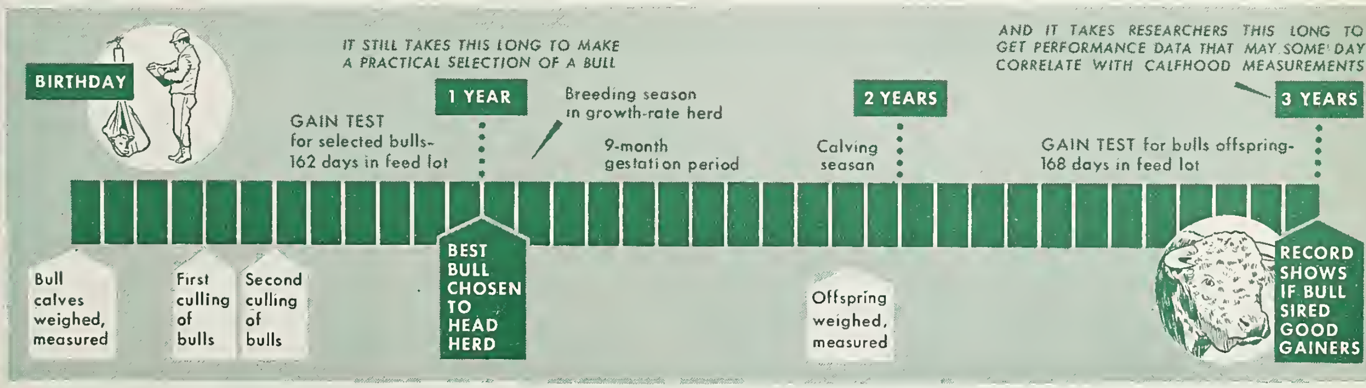
The researchers could breed for type and growth simultaneously, but they believe they can get quicker, better results by breeding for these characters separately. The inbred herd is studied for effects of intensive inbreeding on traits studied in the other two herds. The three kinds of herds are set up as follows:

From a group of 32 females—half-sisters or more closely related—16 are chosen at random for the inbred herd, 8 for the type herd, and the other 8 for the growth-rate herd. Inbred-herd females are bred to a closely related bull—their sire if possible. But new bulls are used each year in the type and growth-rate herds—chosen from any of those three herds once a closed line has been set up. Weight and measurement figures are accumulated on all the calves, and feed-test records of performance are made on all heifers and outstanding bull calves.

While collecting physical data the scientists are also devising standards to measure efficient growth. They use these techniques and standards to select productive breeding stock in existing breeds, and to evaluate breeding systems that involve selection, inbreeding, line breeding, top crossing, and crossbreeding.

The Front Royal studies typify cooperative work by USDA, State stations, and private breeders under the Inter-regional Beef Cattle Breeding Programs.

This work is now in about the same stage as corn breeding was in the early twenties. There seems to be a good chance of comparable gains for livestock.☆



Promise for control of Lymphomatosis

IMMUNIZED HENS PASS ON RESISTANCE TO THEIR CHICKS

USDA SCIENTISTS have succeeded for the first time in immunizing chickens against the costly cancerous disease called visceral lymphomatosis, or *big-liver disease.*

In experiments at the Regional Poultry Research Laboratory, East Lansing, Mich., resistance to lymphomatosis was passed from vaccinated hens to their chicks through the eggs.

The ARS researchers hope this discovery may eventually bring the $50-million-a-year disease under control. Their findings must, of course, be verified first under a variety of conditions, the vaccination technique greatly simplified, and vaccine production put on a practical basis.

These results from vaccination follow closely another significant development at the East Lansing Laboratory—a diagnostic technique that may prove important in identifying the visceral form of lymphomatosis (AGR. RES., Nov. 1954, p. 4; also June 1954, p. 4). The laboratory is jointly administered by ARS and several State experiment stations.

In the recent work on this disease, biologist B. R. Burmester and associates vaccinated hens with a dilute preparation of the visceral-lymphomatosis virus. This preparation was made from diseased chicken livers. In due course, the hens' chicks showed high resistance when tested with potent injections of the virus.

Burmester thinks that vaccination resulted in a buildup in the hens' blood of protective antibodies, substances which the body creates to inactivate disease organisms. Apparently these antibodies were passed in through the eggs to the chicks.

The evidence in this study was gathered from 300 chicks, the progeny of 14 test hens. The chicks from eggs laid *before vaccination* of the hens proved highly susceptible to the disease. Two-thirds of these chicks died of the disease after receiving injections of the virus.

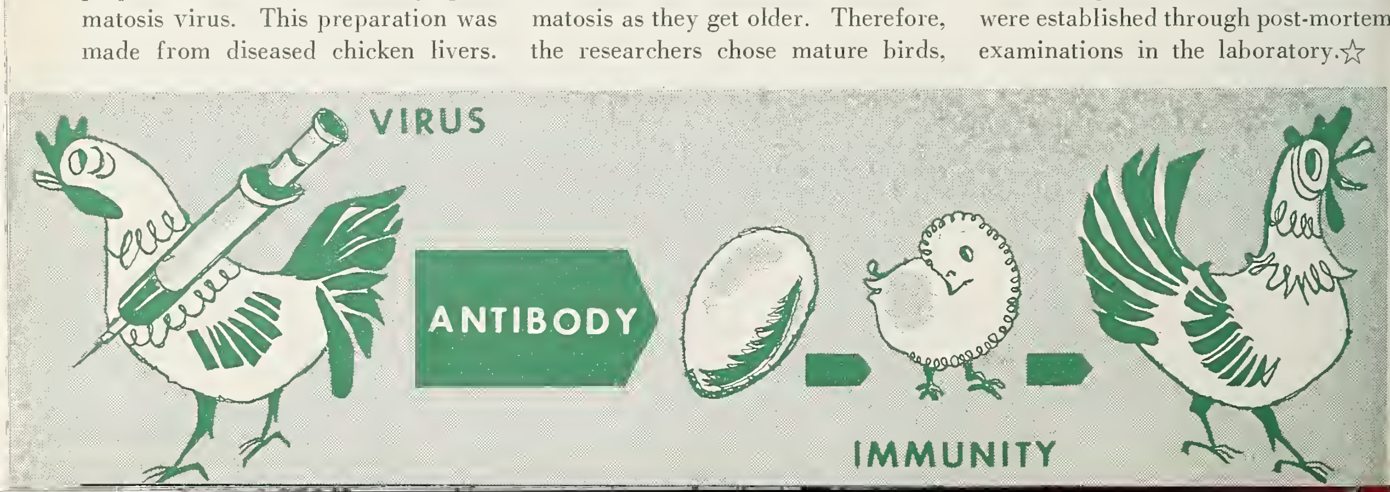
In marked contrast to this, chicks of the same parentage from eggs laid *after their mothers were vaccinated*—in fact, only a few weeks after the laying of the first batch of eggs—had a much smaller incidence of the disease. Only a few of them died of the tumors. Mother-vaccination was the only observable difference between the two groups of chicks.

The East Lansing study used White Leghorn hens of a highly-susceptible strain. These birds—like all other chickens—gain resistance to lymphomatosis as they get older. Therefore, the researchers chose mature birds, which would have a good chance of surviving vaccination.

Before vaccination began, the hens' eggs were collected for 6 weeks and incubated. Then vaccination was started. A preparation containing live virus in low concentration was injected into the hens' veins on alternate days for a week. For the following 3 weeks, thrice-weekly injections were given, using a 10-times-larger dose of the virus preparation. After 10 days, a final injection of this strength was given. Then, starting a week later and continuing for 6 weeks, test eggs from the vaccinated hens were collected and incubated.

To check susceptibility of the chicks, researchers inoculated them with preparations of the active virus that in previous studies had proved potent enough to induce the disease in a high percentage of susceptible chicks. Forty-one to 70 percent of the chicks from non-vaccinated hens receiving inoculations developed tumors and died. Only 3 to 13 percent of chicks from vaccinated hens developed the disease, and on the average they survived longer than susceptible chicks in the other group.

All diagnoses of lymphomatosis were established through post-mortem examinations in the laboratory.☆



ANTIBIOTICS HAVE A FARM FUTURE

Several types of plant disease may yield to drugs

SINCE FARMING BEGAN, men have watched helplessly as their crops were blighted, wilted, rusted—destroyed by any one of the 30,000 important plant diseases.

Plant pathologists have found ways to *prevent* some of these diseases with cultural practices, seed treatment, and fungicidal sprays and dusts. Now, for the first time, we appear to have a way to *cure* diseased plants—with wonder-drug antibiotics.

It was in 1949 that W. J. Smith, then of the Wyoming experiment station, opened the antibiotic door: he demonstrated that treating bean seeds with streptomycin controlled halo blight. His research results stimulated other scientists to investigate the wonder drugs. By the end of 1954, plant pathologists had made progress in using antibiotics against several diseases:

Halo blight of beans. After success in preventing bean blight with antibiotics, ARS scientists proved last year that Agrimycin (streptomycin-Terramycin) sprays would cure both mild and advanced halo infections (AGR. RES., July 1953, p. 12).

Fire blight of pears and apples. Three years of research have established that Agrimycin can control fire blight. In 1954, ARS researchers working in Bartlett pear orchards near Marysville, Calif., found that 5 weekly antibiotic sprays controlled blight as well as 7 standard copper treatments—and without the usual copper-induced russeting of the fruit (AGR. RES., Nov. 1954, p. 7).

Bacterial spot of tomatoes and peppers. Agrimycin sprays have controlled bacterial spot disease in tomato seedlings. Florida station tests showed that this antibiotic gives a high percentage of healthy transplants and reduces carryover of disease from seed bed to field. Florida and Delaware scientists got similar results with peppers.

Wildfire and blue mold of tobacco. Against wildfire, streptomycin sprays gave complete protection in seed beds, eradicating the disease from nearly 90 percent of infected plants in Tennessee-ARS experiments. In ARS greenhouse tests, streptomycin was better than the standard fungicide, dithane, against blue mold.

Seed-piece decay and blackleg of potatoes. Maine researchers found that dipping potato seed pieces in water solutions of streptomycin alone or with terramycin completely halted development of decay. Blackleg, a carryover of seed-piece decay in field-planted potatoes, did not develop from dipped seed pieces.

Black rot of rutabagas. Aureomycin-dipped seed developed no black rot, and much less damage was done to viability than by standard hot-water treatment, the Canadian Department of Agriculture found.

Bacterial wilt of chrysanthemums. New Jersey scientists find that treating cuttings or rooting-soil with streptomycin protects 'mums from wilt and wipes out wilt infections.

All of these (except the fungus blue mold) are *bacterial* diseases—the type for which antibiotic control seems most promising.

But at least one antibiotic—Acti-dione (cyclohexamide)—has been effective against several *fungus* diseases. Michigan tests showed that this drug provides good control of onion mildew and mint rust and excellent control of some grass and turf diseases. Canadian scientists reported promising preliminary results with Acti-dione against race 15B of wheat stem rust; yields from antibiotic-sprayed plots were consistently greater than from rust-infected plots.

Laboratory tests show that these drugs can also inhibit certain *virus* diseases. In Wisconsin, Agrimycin solutions prevented development of tobacco necrosis and tobacco ring-spot symptoms on cowpea leaves. In California, an experimental antibiotic provided 70 to 90 percent control of tobacco mosaic virus.

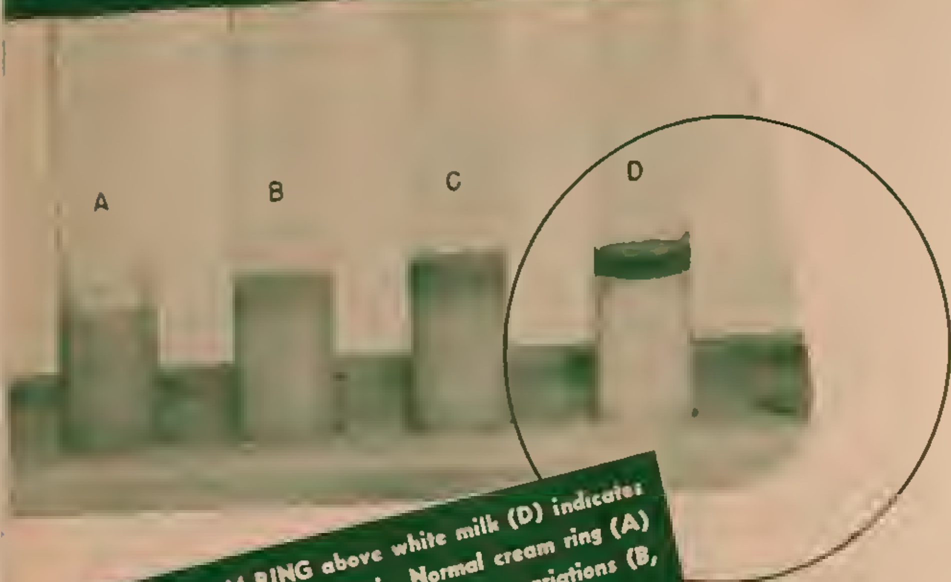
Antibiotics are easy to use as disease-control weapons. They can be readily made up in water solutions, are stable in storage, and mix with other fungicides and seed-treating chemicals. Ordinary fungicides must be applied to plant surfaces, but some antibiotics are systemic—that is, they move through the sap streams. They "grow" with the plants and are proof against rain.

Biggest drawback to wider use of antibiotics is their relatively high cost. But their price is already low enough for seed treatment, spot treatment of turfs (where a little goes a long way), and use on seed beds of high-value crops. Truck crop and fruit growers will no doubt try more antibiotics if research proves that timely single-spray treatments can provide season-long protection.

Plant pathologists across the country are continuing research to learn the full possibilities of these materials. The scientists figure that with the right chemicals in the hands of growers who know how to use them, disease losses might be cut $1 billion a year.☆

The RING TEST spots brucellosis

IT'S A QUICK ECONOMICAL WAY TO SCREEN AREAS FOR INFECTED HERDS



BLUE CREAM RING above white milk (D) indicates herd infection of brucellosis. Normal cream ring (A) shows negative reaction. Intermediate variations (B, C) show possible infection, may need rechecking.

TO WIPE OUT BRUCELLOSIS (Bang's disease) in cattle, we must first locate areas of infection, then track down the disease to individual animals so they can be removed for slaughter.

The whole-milk (cream-ring) test recently adopted by the U. S. Livestock Sanitary Association and approved by USDA's Agricultural Research Service makes it possible to screen entire areas to detect infected herds quickly and economically. Of the dairy herds tested by this method throughout the country, about one-fourth show evidence of brucellosis. Veterinarians make blood tests only in herds where the ring test indicates that the disease is present.

Brucellosis control can be greatly speeded with this test, says veterinarian A. K. Kuttler, head of ARS brucellosis eradication work. The test costs only about one-fifteenth as much as blood-testing all animals in an area.

The ring test is based on the presence of substances called *agglutinins* in milk from diseased cows. These agglutinins are antibodies that the animals have produced to fight the disease. To a small composite sample of whole milk from 5 to 12 cows is added an antigen, a suspension of the *Brucella abortus* organisms that cause brucellosis. This antigen, previously stained blue, clumps with the agglutinins in milk from infected herds. As the cream rises, it carries along the clumps of stained cells, which form a bluish-purple ring. Milk from disease-free herds contains no agglutinins, so the stained antigen remains in the skim milk portion of the test sample.

The ring test is so sensitive that it usually shows positive in mixed milk from 12 or even more cows when only one of the animals is infected. But this test must be made with care. Too much or too little cream in the sample may give a false interpretation. Other variants in milk can also affect the results. The test is most reliable for composite milk samples.

The ring test was developed in Europe. In this country, studies were made in 1950 by M. H. Roepke of the University of Minnesota in cooperation with F. C. Driver and L. B. Clausen of USDA. Extensive field trials followed in several States before the ring test was adopted as an official diagnostic tool.

Since some cows will be dry at test time, the herd should be ring-tested every 4 to 6 months till there's no further danger of infecting the herd.☆

TAKING THE SAMPLE

1 Milk samples are collected at small dairy plants as the milk is poured from cans into weighing vat. In taking sample, a small metal dipper is passed through milk stream below and away from can to avoid heavy collection of cream.

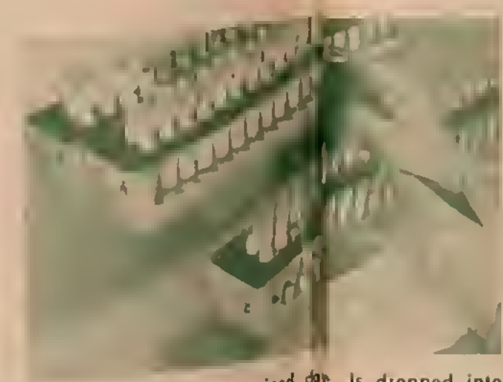
2 Sampling is done from milk cans at larger, faster operating plants. Long-handled dipper is lowered into can below cream line, shaken rapidly several times, then withdrawn. Shaking helps control amount of retained cream.

3 A dipperful (about a teaspoon) from no more than cans of milk from same herd is pooled in test tube. Several tubes may be needed to sample milk of one herd. Tube, labeled with herd source, is stoppered and put in rack.

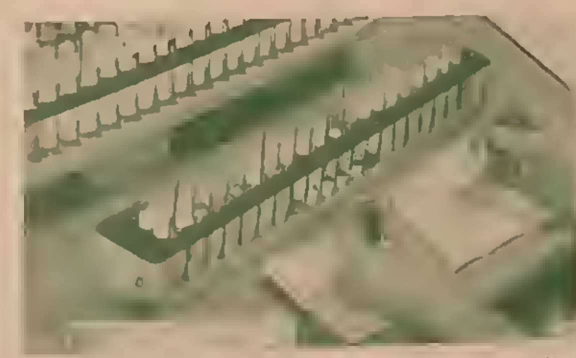
4 Sample tubes are recorded by ARS veterinarian O. J. Hummon on list that shows patron's name, address, county, and number of cattle in herd. Dipper is washed between collections to avoid carryover of infected milk.

MAKING THE TEST

1 Milk samples and two rows of smaller tubes are assembled in special rack. Beginning with "A" side of rack, 1 cc. of milk is poured from each sample tube into small tube in front. Then tubes on "B" side are filled.



2 Ring-test antigen, stained dark, is dropped into each small tube with an automatic dropper that measures out .03 cc. of antigen. The antigen is added in the same order in which test tubes were filled with milk samples.



3 To mix contents, serologist shakes tubes vigorously in a horizontal position. He takes tubes from both ends of rack in turn. The tubes are held for a moment after shaking to release air bubbles before being replaced in rack.

4 Samples are incubated at 37.5° C. (100° F.) for 1 hour after milk and antigen are mixed. Room temperature (70° F.) is satisfactory but takes twice as long. After incubation, results show up clearly, as in photo at top left.

What's the role of bacteria in making silage?

COUNTING MICROBES in forage plants from field to silo is helping USDA dairy scientists learn more about what makes good silage.

Experiments with miniature silos (AGR. RES., August 1953, p. 10) have given workers at the Agricultural Research Center, Beltsville, Md., much information on how forage microorganisms behave during the ensiling process. More recently, ARS bacteriologist L. A. Burkey and associates have reported results of a census of microflora in fresh-cut forage.

They found that bacteria, yeasts, and molds on plants in the field generally become more numerous as the growing season advances. These microorganisms, feeding on plant tissues and juices, multiply very fast when the plants are cut. In alfalfa wilted 2 hours or more, then chopped and blown into the silo, microflora concentration increased 7 to 17 fold. Only part (2 fold) of this increase was due to wilting alone.

Most microorganisms in fresh-cut forage are aerobic—require free oxygen for growth. Much less numerous—but probably more important to silage—are microbes that grow best *without* free oxygen. Some of these are desirable, others not. The useful ones produce lactic acid, necessary for good silage. Some undesirable bacteria yield butyric acid, which makes silage foul smelling, unpalatable, and low in nutritive value.

Good silage seems to depend on maintaining conditions favorable to the lactic-acid-producing bacteria, unfavorable to butyric-acid producers. The large numbers of aerobic microbes naturally present in forage may help. Multiplying at great speed as ensiling begins, they use up the oxygen in an air-tight silo in a few days. Then they disappear, giving way to the acid-producing bacteria, which don't need free oxygen.

Abundant natural sugars in plants also encourage desirable bacteria. Yet some valued forage crops such as alfalfa are low in sugar. It has long been observed that wilting of low-sugar plants before ensiling, or addition of chemicals such as sulfur dioxide, helps improve silage (AGR. RES., September 1954, p. 14).

Apparently there's a critical balance between moisture content and amount of natural sugars. Silage crops high in sugars (corn stover and some grasses, for example) can be ensiled satisfactorily when their moisture is high. Low-sugar plants (such as legumes) appear to benefit from wilting to reduce moisture. Adding an easy-fermenting carbohydrate (such as molasses) to low-sugar plants, a common practice, may further aid desirable microbes.☆

How to stretch Northern Great Plains pastures

BETTER GRASS-ALFALFA mixtures could give Northern Great Plains dairymen more and cheaper milk than they're getting on native pasture. This is shown by 7 years of ARS experiments at Mandan, N. Dak.

Native grass—the usual outdoor fare of dairy cows in this region—provides good milk-producing feed for only a month or two during spring and early summer. By growing various tame perennial and annual grasses and alfalfa at Mandan, researchers R. F. Gaalaas and G. A. Rogler prolonged grazing time to as long as 3 or 4 months and stepped up milk production by 50 to 100 percent.

An excellent forage combination for longer grazing, they report, is Ladak alfalfa, crested wheatgrass, bromegrass, and Russian wildrye. This gave much better grazing than native grass in July and August, and as good or better grass in June. Even when grazed down, the plantings recovered well enough for a second grazing in 3 out of 5 summers.

The grazing season could be lengthened still further by an autumn period on native grass. Though not milk-stimulating when mature, it appears to retain its nutritive value better than tame grasses.

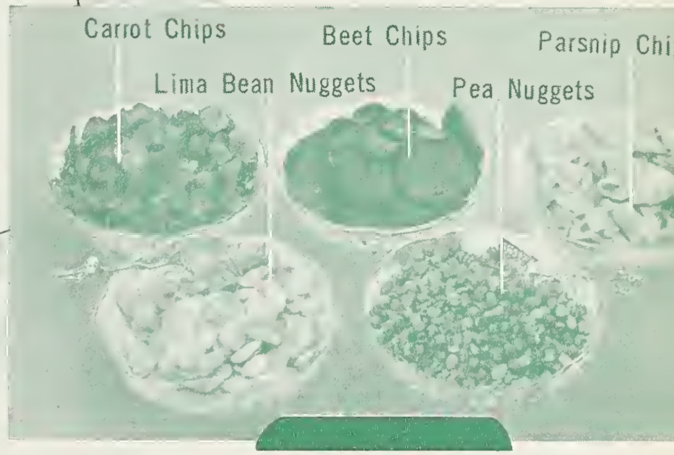
Second-best means of stretching out grazing time was to plant the pasture to crested wheatgrass. This was always the first of the experimental pastures to be ready in spring, and it recovered to give a second grazing period later each year.

Sudangrass made excellent forage with ample rain but was badly stunted by dry spells and didn't recover well from initial grazing. Even so, it gave good grazing when most needed.

In these experiments (1947–53), Holstein cows grazed different types of pasture rotationally. They received no other forage but got 1 pound of concentrates for each 4½ pounds of milk produced.

Milk production on grass-alfalfa mixture averaged 1,814 pounds per acre for the grazing season, compared to 1,507 on crested wheatgrass, 1,023 on sudangrass, and 880 on native grass. Butterfat yields ranked in the same order, from an average of 60.9 pounds on grass-alfalfa to only 29.3 pounds on native grass.☆

TASTY NEW Snacks



Familiar vegetables make appealing deep-fat-fried chips and nuggets

PEOPLE WHO LIKE potato chips—and who doesn't?—will be glad to hear that new just-can't-stop-eating-'em snack items are coming. They are vegetable *chips* and *nuggets*—from carrots, beets, parsnips, peas, and lima beans—developed at USDA Eastern Regional Research Laboratory, Wyndmoor, Pa.

Simple to make, these crisp and tasty vegetable products offer potato-chippers an added line of foods with potentially wide appeal to consumers. Like potato chips, the new snacks are prepared by deep-fat frying. Carrot, beet, and parsnip chips retain the characteristic taste of these vegetables. The nuggets, made from peas and lima beans, have a nutlike flavor uniquely their own.

To make the chips, beets and carrots are sliced 1/16-inch thick, parsnips to 1/32 inch. Peas and lima beans are used whole, but the limas require a pre-treatment by blanching (scalding) to loosen the seed coats, which come off in frying.

ARS researchers at Wyndmoor found that a modified coconut oil is the most satisfactory fat for frying the new products. It doesn't harden on the chip surface at room temperature, and foods made with it keep a long time without becoming rancid. Other oils—peanut, corn, or cottonseed, for example—may work just as well for chips to be marketed quickly.

Spinning the chips in a basket-type centrifuge immediately after frying may be desirable to reduce their oil content. Vegetable chips can be flavored with salt, garlic, celery, parsley salt, bacon-flavored powder, and the like. Unique flavors may also be obtained by longer-than-normal frying—for instance, overcooked lima-bean nuggets have a toasted-almond flavor. All these french-fried foods are tastier when they're warmed in an oven before serving.

Besides their use as snack items, nuggets from peas and lima beans can be ground into soup powders that reconstitute in hot water in a few minutes. French-fried peas, ground and mixed with hickory-smoked protein powder (already available commercially), provide a packaged soup mix housewives could prepare for serving in a few minutes—and it tastes just as good as old-fashioned ham-and-pea soup. These developments offer a potentially wide outlet for large size, very mature peas, which tend to move slowly in present markets.

Like potato chips, the new vegetable chips should be popular as a nutritious snack for energy-consuming youngsters. Fried lima beans and peas can be compressed into bars for possible use as quick-energy food items in military rations. All the chips are high in carbohydrate and fat. Carrot chips are exceptionally rich in carotene (provitamin A), while the peas and lima beans provide a concentrated source of protein.

When fried in oil of high stability, chips and nuggets keep well for 6 to 12 months or maybe longer at room temperature. Their high carotene content makes carrot chips somewhat less stable than the other products.

Though no commercial-scale production has yet been undertaken, major food processors are actively interested in these new products.☆

CLOSER PLANTING • More Cotton

THE TREND'S TO THICK STANDS, BUT HOW THICK SHOULD THEY BE?

TRADITIONAL VIEWS on cotton plant spacing are changing as machines and research cause us to prepare our soil, apply fertilizer, and control insects in new ways.

Time was when cotton growers drilled seed in copious quantities, then thinned the plants to a desired stand. Higher seed and labor costs now make this practice prohibitive.

The modern trend is to higher plant populations per acre. Tests over a period of years in major producing areas have shown that such plantings produce better yields and insure more efficient mechanical harvesting. USDA scientists and State cooperators are seeking to determine proper spacing for various producing areas and cotton varieties.

Today, planting, cultivating, and harvesting machinery require at least 36 inches *between* cotton rows (39 inches is near average). Thus, mechanization limits close plant spacing to that done *within* the row.

Best plant populations for dry-farming areas and the rainy Southeast now range from 20,000 to 60,000 per acre. In areas of irrigated production, such as California, Arizona, and New Mexico, findings show that 30,000 to 70,000 plants per acre give best results. Cotton plant populations a few years ago seldom exceeded 25,000 per acre anywhere.

More and more farmers are planting to predetermined stand. That's possible with delinted seeds that drop singly and high-speed planting machinery that places them precisely. Then, too, using pre-emergence sprays to control weeds makes it necessary to leave stands as they come up—choping to thin would break the chemical barrier on the soil surface, let weeds come through.

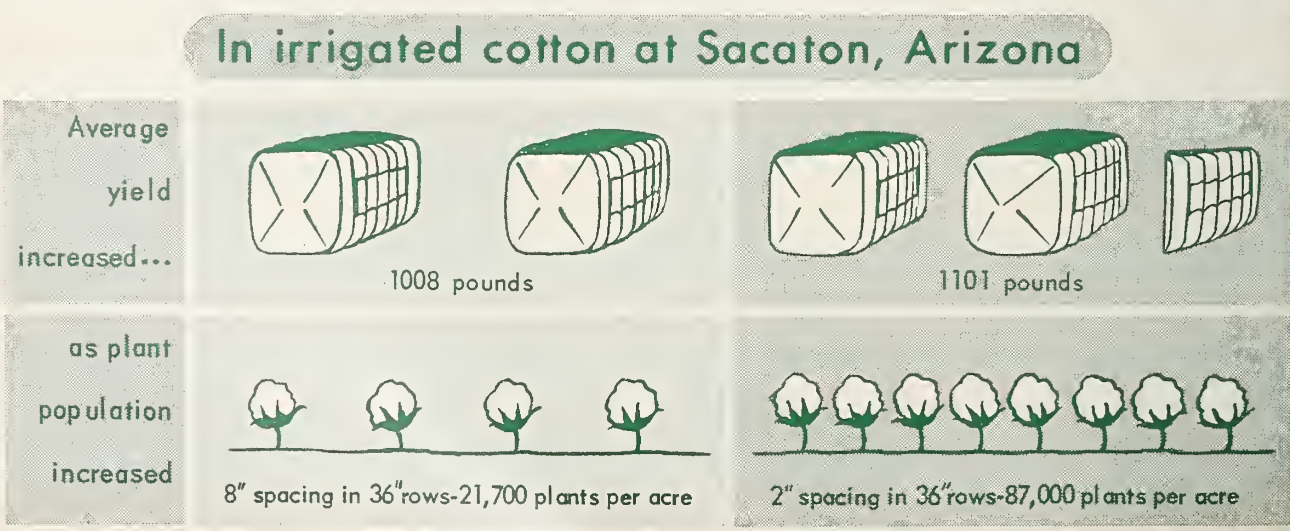
Many factors other than yield and harvesting efficiency must be considered in deciding on best plant spacings for various areas. Spacing for highest yield is not always best for the producer, and overcrowding may even lower yield.

In ARS test at Sacaton, Ariz., dense populations in irrigated cotton sometimes produced tall, top-heavy plants, which are likely to lodge. Dense foliage excludes sunlight, invites boll rot, and hinders chemical defoliation and mechanical harvesting. Agronomist R. H. Peebles found that both Upland and American-Egyptian cotton matured later as the plant stand was increased. Boll size was reduced by close spacing in Upland cotton, but only by extreme crowding in American-Egyptian.

Industry is greatly interested in the properties of raw cotton for manufacturing, especially for certain end-uses. We're studying the effects of changing cultural practices on length, strength, fineness, and spinning performance of cotton fiber.

In the Arizona work, close plant spacing didn't alter fiber length but did reduce strength in 8 of 14 tests. Upland cotton lost 2.6 percent in fiber strength, American-Egyptian cotton, 1.3 percent. These losses were largely offset to the grower by yield gains from close spacing. Fiber fineness was little affected: greater fineness was found in only one Upland test plot, slight coarsening in American-Egyptian cotton.

Yarn strength decreased as plant spacings were reduced from 14 to 2 inches in the Upland experiment.☆



RICE bran yields oil, wax

SIMULTANEOUS PRODUCTION OF OIL AND WAX from rice bran is a new achievement of USDA scientists. This research marks the first time a practical method has been developed for the manufacture of wax from rice bran.

The result is a fine, hard, high-polish wax for housewives, added income for rice-oil producers, and a domestic product to relieve dependence on an imported one.

The United States imports practically all its hard vegetable waxes—used for polishes, carbon paper, food wraps, and vegetable coating. In 1951, we brought in 26,340,000 pounds of such waxes, worth $21,082,000.

Wax from rice bran should replace some 750,000 pounds of imported wax annually. Based on a yield of 0.25 percent of hard wax from rice bran, a 100-ton-per-day solvent-extraction plant would produce approximately 500 pounds of wax. That could mean added profits of $90,000 to $125,000 for a 250-day processing year.

This hard, non-tacky rice wax of high melting point—about 174° F.—can be made by two methods that use a single solvent (hexane) and at the same time produce oil:

1. Cold hexane extraction of cooked rice bran to remove oil, followed by hot hexane extraction to remove wax, and chilling the wax slurry to precipitate wax.
2. Single hot hexane extraction of raw or cooked bran to remove oil and wax, chilling to separate wax from slurry, followed by multiple washes with cold hexane.

Developed at the ARS Southern Regional Research Laboratory and based on filtration-extraction principles, both methods were tried on a pre-pilot-plant scale.

The additional equipment investment and operating costs to produce wax from rice bran are reasonable. A plant producing rice-bran oil by the filtration-extraction process would require no other buildings except a cold room for simultaneous production of oil and wax. Steam, water, and electrical services already available should be sufficient or require little change.☆

WALNUTS need warm weather

LIBERAL APPLICATION OF NITROGEN to walnut trees may increase yields but can't be counted on to improve nut quality. In fact, high growing-season temperatures with lots of sunshine will probably do more to produce good-quality walnuts than any fertilizer treatment.

These are the conclusions of USDA horticulturist J. H. Painter after a 5-year study of walnut fertilizing practices in Oregon. This ARS research involved testing the effects of four nutritional elements—nitrogen, phosphorus, potassium, and magnesium—used to fertilize Franquette walnut orchards. Nitrogen was the only element that had any significant effect.

Trees in carefully controlled plots in non-irrigated hillside and valley orchards were given annual applications of the elements plus 4 pounds of agricultural-grade borax per tree to supply the boron needed. The materials were broadcast by hand between February 15 and March 15 and were disked in when the winter cover crops were turned under, usually by April 15. Six pounds of nitrogen were applied to each tree.

Nitrogen was found to increase both yield and size of walnuts, but there was no comparable increase in kernel quality. Yields may be large when the growing season is cool and cloudy, but these conditions seem to cause greater shriveling of kernels. Though warm weather appears essential for high-quality walnuts, excessive temperatures—either too high or too low—prove harmful.☆

PECANS respond to nitrogen

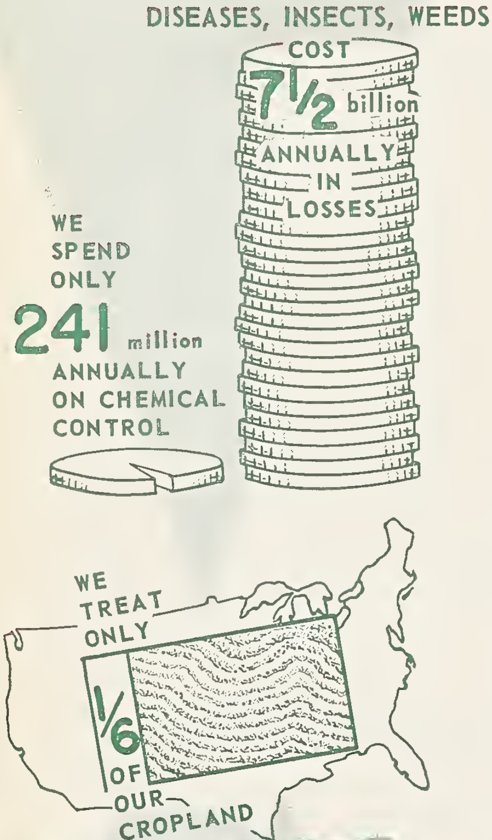
NITROGEN IS THE ONLY MAJOR NUTRIENT readily used by pecan trees during the same season it is applied. Fertilization with nitrogen is usually one of the best ways to boost nut yields since it's more often lacking in pecan-orchard soils than any other essential nutrient. Nitrogen can be conveniently applied—in either spring or fall—and the cheapest kind available can be used.

Merits of spring and fall applications of 4 nitrogen fertilizers on Schley pecan trees were checked in 2 orchards at the USDA Pecan Field Laboratory, Shreveport, La., by ARS scientists C. L. Smith and A. O. Alben. Trees in one orchard were about 49 years old, in the other 25 years old. Fertilizers used were calcium cyanamid, ammonium nitrate, sodium nitrate, and ammonium sulfate. Each was applied in October 1953 and March 1954 to comparable lots of trees. Broadcast in a circular area around the tree and extending a little beyond the branch spread, the fertilizer was then disked in.

Smith and Alben found no significant differences in nitrogen content of leaves collected from trees in June 1954, regardless of nitrogen source or time of application. The scientists conclude that when equivalent amounts of nitrogen are used, pecan growers can expect equally good results from any of the four fertilizers. Time of application can be suited to the system of management.☆

WHAT WE SPEND ON CROP PESTS

Nationwide survey shows how farmers use chemical control



USDA ECONOMISTS say farmers spend about a quarter of a billion dollars a year for chemicals to fight weeds, insects, and diseases on one-sixth of our cropland.

High cost? Yes, but it doesn't seem so large when compared with the estimated \$7.5-billion pest loss that still occurs there and on the other five-sixths of the cropland.

The size of our annual bill for chemical pest control is revealed by a nationwide survey, made with the aid of 23,500 farmer correspondents.

This showed that farmers pay about \$241 million for these chemicals and for custom pest-control services on crops and range—\$193 million for insects and diseases, \$48 million for weeds. That doesn't cover cost and upkeep of farmer-owned sprayers or dusters or charges for the farmers' own labor or for cultural control measures. Nor does it cover seed treatment, control of rats, mice, and insects in farm-stored grains, soil fumigation for nematodes, or insecticides mixed with fertilizers.

Farmers treated about as many acres for weed control—31 million acres—as they did for control of both insects and diseases—29 million acres. Probably not more than 3 million acres received both treatments.

Sprayers and dusters are as common on modern farms nowadays as the moldboard plow in grandpa's day. Their production is a \$35-million-a-year business — six times greater than before World War II. Farmers use them the year round. With many modern tractor-mounted sprayers you can spray while you till. Now, nearly all herbicides are applied as sprays, and sprayers are gaining popularity in the application of other pesticides. However, the power insecticidal duster continues most important in the Cotton Belt and in some areas where specialized crops are produced.

The frequency of chemical use varies with purpose, with crop, and with other conditions—1 application per season for controlling weeds, nearly 3 for insects and diseases. Potatoes get more treatments than any other crop—over 5 per season, nationally, but in Pennsylvania more than 11 treatments in 1952, on a total of 60,000 acres.

Farmers do most of their own spraying and dusting. Custom operators do 30 percent of it, nationally, but over half of it in the Mountain and Pacific Coast States. More than 80 percent of the total custom cost is for insect and disease control.

Chemical weed control is important in the Great Plains, the Corn Belt, and the Mountain and Pacific Coast areas. They use three-fourths of all the herbicides, mostly on small grains. Herbicides for some 17 million acres of small grains cost 66 cents an acre once over—complete custom application, \$1.84 an acre.

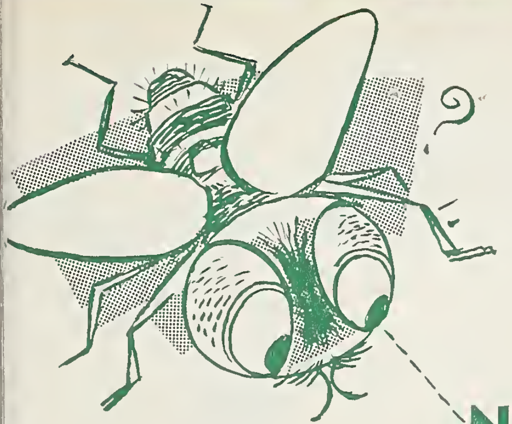
Chemical weed control is practiced on more than 9 million acres of corn (11 percent of the total), more than 2 million acres of pasture, and 2.6 million acres of other crops.

Nearly two-thirds of all insect and disease control centers in the Cotton Belt—Oklahoma and Texas east to the Atlantic—and among the diverse crops of the Pacific Coast.

About 13 million acres of cotton—nearly half of the total acreage grown in 1952—were treated an average of 3 times to prevent insect damage. That cost about \$64 million.

Some 3.5 million acres of fruits and nuts were sprayed or dusted an average of 4.5 times during the season to control insects and diseases. This cost \$63 million. Growers did 85 percent of this at a cost of \$3.20 an acre for materials only. They contracted for der at about \$8.42 an acre, applied.

Insect and disease control chemicals were used on about 2¼ million acres of commercial vegetables, 1 million acres of potatoes, and 1½ million acres of tobacco (80 percent of the crop). Three million acres of alfalfa and clover were treated at a cost of nearly \$10 million. Corn treatment ranged from 400,000 acres in 1952, a light borer year, to 2.5 million acres in 1949, a record borer year.☆



New slant on INSECT CONTROL

INDIRECT DESTRUCTION—A NEW CONCEPT in insect control with chemicals—is being explored by USDA researchers at Beltsville, Md.

Generally, scientists concerned with insect control screen chemicals with one thought in mind: Will low concentration kill a high percentage of insects? Toxic effects other than death or knockdown usually are ignored. Now insect physiologists and chemists, working as a team, are finding that a great number of "non-toxic" chemicals can inhibit the normal development of insects—in the end, cause their death.

Preliminary laboratory screening tests by ARS entomologist Norman Mitlin and chemist M. S. Konecky (resigned) indicate that a wide variety of chemicals have growth-inhibiting qualities. Some prevent cell division and growth, like colchicine and aminopterin. The latter is known in human medicine for its ability to retard rampant division and increase of white blood cells in leukemia. Other chemicals, like sulfanilimide and coumarin, slow down an insect's metabolism. And many compounds that work in various other ways show promise.

One likely chemical that has been more fully tested against houseflies is piperonyl butoxide. It's usually considered non-toxic alone but a booster when added to many other insecticides. Mitlin and Konecky found, surprisingly, that it is effective alone against houseflies when blended with the bran-malt-yeast rearing medium. The chemical slows down development of larvae—prevents many from becoming adults.

In these tests, the greater the piperonyl butoxide dose, the greater its effect. When it comprised 0.111 percent by weight of the rearing medium, only about one-fourth of the flies developed into adults, and those that did took 2 extra days in the process. When it comprised 0.250 percent of the mixture, practically no flies reached adulthood.

It's notable, too, that piperonyl butoxide affected DDT-resistant flies more than normal flies. Only 3 percent of the resistant-fly larvae reached adulthood when raised on a medium containing 0.167 percent of the chemical, whereas 16 percent of the normal flies survived.

These studies—designed to find out how insects react to various chemicals, short of dying—have barely opened up the problem. Much work will have to be done before practical applications can be recommended. Nevertheless, there are indications that you may be hearing more about these "slow-down" chemicals within the next few years.☆

Readers' REACTIONS

Explanation

SIR: I have just read the article "This Will Save Cattle" [Feb. 1955, p. 10]. I am a little lost in trying to follow the percentages.—H. E. JAMISON, Secretary-Treasurer, Inter-state Milk Producers' Cooperative, Philadelphia.

● We stated that "The present and the new interpretations of the blood test [for brucellosis] were each applied to data from the same cattle vaccinated in calfhood. The new interpretation showed 500 percent more negative animals, 300 percent fewer reactors, and nearly 40 percent fewer suspects."

We were in error. In explanation, 637 head of cattle, vaccinated in calfhood were tested as adults and the results compared by the two interpretations. The new method showed 418 percent more negatives (352 head compared with 68 by the old interpretation), 71 percent fewer reactors (51 compared with 176), and 40 percent fewer suspects (234 compared with 393 head by the old method).—ED.

Information

SIR: I notice that mention is made of the preservation of potatoes by drying as far as 2,000 years ago ["It's Done with Potatoes," Feb. 1955, p. 12].

. . . To the best of my knowledge, these Inca Indians [the Andes Mountains dwellers from whom the Spaniards took tubers about 1586] left no written records, and I am interested in discovering all there is to know about this product.—BEN DAVIDSON, Administrator, Oregon Potato Commission, Redmond, Oreg.

● One writer, R. N. Salaman, discusses South American archaeological discoveries at length in his book The History and Social Influence of the Potato, Cambridge University Press, 1949.

Salaman dates drying of the potato possibly 2,000 years ago in South America, cultivation well before that.

Mr. Davidson's letter was referred to Dr. C. Evans, Smithsonian Institution archaeologist, for more information.—ED.

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agrisearch notes

EMERALD ZOYSIA, a superior new hybrid lawn grass, has been released to nurserymen by the Georgia Crop Improvement Association, Athens. Plugs and sprigs for vegetative propagation of this wide-cross hybrid should be generally available in Spring 1957.

Developed in 1949 by ARS agronomist Ian Forbes, Emerald zoysia appears well adapted throughout the Southeast and may do well in some areas farther north. Its ability to produce leaves on short stems enables Emerald zoysia to be clipped closely without "browning-off."

This new grass combines the winter hardiness, non-fluffy growth habit, and fast rate of spread of one parent (*Zoysia Japonica*), with the finer leaves, denser turf, and darker green color of the other parent (*Z. tenuifolia*).

TOXIC LIFE IS LENGTHENED for 6 organic phosphate insecticides by adding resin-like chemicals known as chlorinated terphenyls.

USDA research under laboratory conditions at Beltsville, Md., showed that these extenders lower the evaporation rate of normally-volatile parathion, malathion, diazinon, L 13/59, the new DDVP (dimethyl 2,2-dichlorovinylphosphate), and the latter's diethyl homolog. This method is being field-tested for practicability at Orlando, Fla.

The ARS researchers—chemist Irwin Hornstein and entomologists W. N. Sullivan, Jr., and Ching Hsi Tsao—previously got similar results by adding these extenders to chlorinated hydrocarbon insecticides such as aldrin and lindane (AGR. RES., Sept. 1954, p. 15).

Chlorinated terphenyls extended the toxic life of the five phosphates in tests against houseflies, roaches, and the confused flour beetle. Results were quite striking with DDVP and its homolog. Those two insecticides, used alone, were lethal *less than 2 days,* but in combination with the extender were still killing all insects *after 60 days.*

Against houseflies, use of chlorinated terphenyls lengthened the lethal life of various insecticides as follows: parathion from 10 days to 30 days, diazinon from less than 5 days to 30 days, malathion from 5 days to 10 days, and L 13/59 from less than 4 days to 10 days.

These insecticides, except for malathion, had their longest effectiveness when mixed in the proportion 1 part of insecticide to 4 parts of extender. But the less-volatile malathion remained effective longest when it and the chlorinated terphenyl extender were mixed in equal parts.

MORE VIRUS-FREE STRAWBERRIES are ready for Eastern growers this spring. Besides 8 varieties made available last year (AGR. RES.. July 1953), substantially virus-free stocks of 16 others are now being offered: Albritton, Armore, Aroma, Bellmar, Dixieland, Dunlap, Fairfax, Massey, Midland, Missionary, New York, Pocohontas, Robinson, Stelemaster, Tennessean, and Vermilion.

Hordes of virus-carrying aphids have made development of virus-free stocks a tougher job in the West. At Corvallis, Oreg., ARS pathologists P. W. Miller got rid of non-persistent viruses in plants of 5 western varieties by air treatment at 98° F. for 6 to 14 days. More research will tell if the plants are free of *all* viruses.

U. S. GOVERNMENT PRINTING OFFICE: 1955